PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-247386

(43)Date of publication of application : 30.08.2002

(51)Int.Cl. H04N 1/46
B41J 2/525
G03G 15/01
G03G 21/00
H04N 1/60
H04N 1/41

(21)Application number : 2001-041650

(22)Date of filing : 19.02.2001

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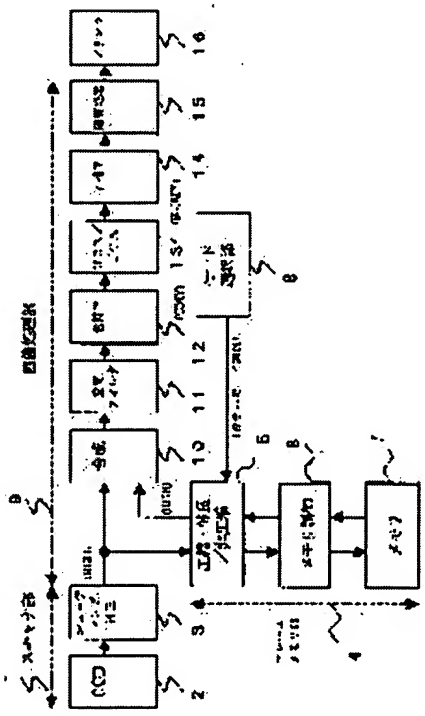
(54) COLOR IMAGE-PROCESSING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an image-processing device having a frame memory for efficiently using a general-purpose memory chip.

SOLUTION: The color image-processing device comprises a mode selection section 8 for selecting either a full-color mode or a black-and-white mode, a color conversion circuit for converting the color of RGB data, a compression/ decompression section 5 for compressing color conversion data in 2×2 pixel block units, a selector for selecting compression data or data before compression, a memory control circuit 6 for storing selected data at a frame memory 7, the compression/decompression section 5 for decompressing data read from the frame memory 7, a selector for selecting either the decompression data or data before decompression, and an inverse color conversion circuit for inversely converting the color of the selected data to RGB data. The two selectors select compression and decompression data when the full color mode is selected.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] In the color picture processor which separates the color of a manuscript into RGB, reads in digital one, and regenerates a color picture in digital one using the color material of YMCK from the read image data A mode selection means to choose the full color mode or monochrome mode, and the color conversion means which carries out color conversion of the RGB data, A compression means to compress color translation data per 2x2 pixel block, and the 1st data selection means which chooses compressed data or the data before compression, The memory control means for memorizing selected data in memory, and an expanding means to elongate the data which read from memory, It has the 2nd data selection means which chooses expanding data or the data before expanding, and the reverse color conversion means which carries out reverse color conversion of the selected data at RGB data. The 1st and 2nd data selection means It is the color picture processor characterized by choosing compression and expanding data when the full color mode is chosen.
[Claim 2] The color picture processor according to claim 1 characterized by setting the compressibility at the time of color mode to one third.
[Claim 3] A color conversion means is a color picture processor according to claim 1 characterized by changing RGB data into YUV data [Y= (R+2 G+B)/4, U=R-G, V=B-G].
[Claim 4] The data memorized in memory at the time of monochrome mode selection are a color picture processor according to claim 1 characterized by being Y data.
[Claim 5] The data memorized in memory at the time of monochrome mode selection are a color picture processor according to claim 1 characterized by being G data.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to color picture processors, such as full color and a digital color copying machine which forms an image in monochrome mode, and color facsimile.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to color picture processors, such as full color and a digital color copying machine which forms an image in monochrome mode, and color facsimile.
[0002]
[Description of the Prior Art] Generally, in the digital copier, the manuscript image was read for every pixel using CCD series etc., A/D conversion of the analog electrical signal acquired by the output of image sensors was carried out, after performing various processings to the digital signal acquired, the signal was given to the recording device and the copy image has been obtained. In a digital color copying machine, the color is separated into R (red), G (Green), and B (blue), the manuscript which should be copied is read, the color material of Y (yellow), M (Magenta), C (cyanogen), and K (black) is used based on this image data, and a color picture is reproduced.
[0003] There are some which are shown in JP,63-107274,A as such color picture formation equipment. The equipment shown in this official report repeats only the class of color material using the process which twists the recording paper around an imprint drum, forms in Junji Men the image corresponding to the color material of two or more colors used for record at photo conductor drum lifting, and is imprinted on the recording paper. That is, when reproducing a color picture by four colors of YMCK, 4 times of imaging processes will be repeated.
[0004] On the other hand, the engine performance of a color copying machine is also improving and 50cpm (part for copy/) extent is put in practical use in one color also in the imaging equipment (printer) of the above-mentioned 1 drum type in 600dpi and a copy speed by the pixel consistency. In order to improve the copy speed and pixel consistency of image formation equipment, the method of securing light exposure is also put in practical use by changing the beam which makes the laser beam of writing plurality and uses it for every line.
[0005] On the other hand, in a manuscript reader (scanner), in order for the quantity of light to run short since pixel size becomes small by the increment in a pixel consistency, and to obtain the image data of the quality of a moderate noise level (S/N ratio), reading speed can seldom be gathered. Therefore, there was a problem that the speed of a scanner was slow compared with a printer, and a copy speed was restricted to the speed of a scanner.
[0006] In order to cancel this, manuscript reading data are once memorized to a frame memory, and the approach of forming an image at a high speed is proposed by reading image data from memory to a high speed according to a write-in speed of a printer. Also in this case, when it is attached to the manuscript of one sheet and one sheet is copied, a copy speed falls, but effectiveness becomes large, so that N becomes large, when it is attached to the manuscript of one sheet and two or more copies (N sheets) are carried out.
[0007] Furthermore, when connecting two or more sets of printers, the data memorized by the frame memory can be read, it can transmit to two or more sets of printers, and a copy can also be created to juxtaposition. However, in order to memorize image data by 1 page, there is a problem that huge

memory is required and becomes cost high.
[0008] Then, although a data compression technique is used, the image data quality after compressibility, and compression / expanding has the relation of a trade-off. In the case of a color copy, though a certain amount of compression was required, there was nonconformity which image degradation produces by compression and elongating also to monochrome manuscript with the amount of data [at least] sufficient from the first.
[0009] For this reason, with the technique shown in JP,9-102878,A, compression / expanding processing is performed at the time of a color copy, and it is made to read by memorizing the data for the black versions in memory to monochrome manuscript, while it has been incompressible.
[0010]
[Problem(s) to be Solved by the Invention] However, according to the compression approach shown in this official report, there were whether being useless and big nonconformity to a memory chip that it was generated and the effectiveness of a cost cut was not acquired enough. This nonconformity is explained. In consideration of the greatest image data size, it may be 12 inch x17 inch to the A3 version and DLT (double letter) size. When a pixel consistency is set to 600dpi and it is RGB each color of 8 bits/pixel, the amount of data is -(12-600) (17-600) -8 (bit/color) and 3(color) =1,762,560,000 bit =1680.9M bit. If this is compressed by the fixed length of compressibility 1/3, memory (1680.9M bit / 3=560.3M bit) is required.
[0011] In JP,9-102878,A, in order to compress with one third of compressibility for every block of 4x 4= 16-pixel size, it becomes 4-4-8 (bit/color)-3 (color) / 3= 128-bit amount of data. For this reason, the memory chip of 128 / 16= 8 multiples is needed noting that the word length uses the memory chip of 16 bit patterns.
[0012] In this case, since the total capacity is 560.3M bit, when the memory chip of 64 M bit capacity is used, it revalues and a 2 set x8 piece =16 piece chip is needed [it is 560.3M/8/64M=1.09 and]. If the memory chip of 128 M bit capacity is used, since it is 560.3M/8/128M=0.54, it revalues and a 1 set x8 piece =8 piece chip is required. therefore, the memory space mounted -- 64M and 16=1024M bit, and 128M and 8=1024M bit -- it is -- any case -- initial-complement 560.3M bit -- receiving -- no less than 45% -- although -- it becomes useless.
[0013] This invention aims at offering the image processing system which has the frame memory which can use a general-purpose memory chip efficiently.
[0014]
[Means for Solving the Problem] In order to attain the above-mentioned object, invention according to claim 1 In the color picture processor which separates the color of a manuscript into RGB, reads in digital one, and regenerates a color picture in digital one using the color material of YMCK from the read image data A mode selection means to choose the full color mode or monochrome mode, and the color conversion means which carries out color conversion of the RGB data, A compression means to compress color translation data per 2x2 pixel block, and the 1st data selection means which chooses compressed data or the data before compression, The memory control means for memorizing selected data in memory, and an expanding means to elongate the data which read from memory, It has the 2nd data selection means which chooses expanding data or the data before expanding, and the reverse color conversion means which carries out reverse color conversion of the selected data at RGB data. The 1st and 2nd data selection means When the full color mode is chosen, it is related with the color picture processor characterized by choosing compression and expanding data.
[0015] Moreover, in invention according to claim 2, it is characterized by setting the compressibility at the time of color mode to one third.
[0016] Moreover, in invention according to claim 3, a color conversion means is characterized by changing RGB data into YUV data [Y= (R+2 G+B)/4, U=R-G, V=B-G].
[0017] Moreover, in invention according to claim 4, the data memorized in memory at the time of monochrome mode selection are characterized by being Y data.
[0018] Moreover, in invention according to claim 5, the data memorized in memory at the time of monochrome mode selection are characterized by being G data.

[0019] The frame memory which can use a general-purpose memory chip efficiently consists of invention of claims 1, 2, and 3. Moreover, monochrome copy image of a good gradation property is visually obtained by low cost. Moreover, monochrome copy image of sharp image quality is obtained by low cost.
[0020] In invention of claim 4 and five publications, incompressible data are efficiently memorized by memory at the time of monochrome mode. Moreover, a compressing expanding circuit with sufficient image quality consists of low cost.
[0021]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing. Drawing 1 is the block diagram of the color picture processor concerning the gestalt of operation of this invention. A whole configuration and actuation are explained first. A manuscript is outputted as RGB eight bit data each, after being read by CCD (image sensors)2 of the scanner section 1, being changed into an electrical signal and performing a shading compensation in the shading compensation section 3. RGB data are usually once memorized by the frame memory 7 of the frame memory section 4.
[0022] In the frame memory section 4, synchronizing with reading actuation of the scanner section 1, at the time of the full color mode, compression processing is performed in compression / expanding section 5, and a color mode selection signal is memorized by the frame memory 7 through the memory control circuit 6. At the time of monochrome (or single color) mode, a color mode selection signal is memorized by the frame memory 7, while it has been incompressible. Here, a color mode selection signal is outputted from the mode selection section (a control panel is used in practice) 8.
[0023] Manuscript reading actuation is completed, and if the image data for 1 page is memorized by the frame memory 7, it will move to imaging actuation. Reading appearance of the image data is carried out synchronizing with imaging actuation of a printer, and corresponding to the color mode selection signal specified at the time of storage, at the time of the full color mode, expanding processing is performed in compression / expanding section 5, and it changes into RGB data and outputs from a frame memory 7. At the time of monochrome (or single color) mode, it outputs as RGB data as it is. However, since the incompressible data memorized by monochrome mode are data of 1 classification by color, brightness data or G is made into RGB color data common data, and they output it as R=G=B (read-out data).
[0024] In the image-processing section 9, the RGB data by which reading appearance was carried out are received from a frame memory 7 in the synthetic circuit 10. although the synthetic circuit 10 is a circuit which compounds the data from a frame memory 7, and the data of another manuscript which carried out reading appearance, and which was sometimes read in the SUKYASU section 1, since data reading appearance is usually carried out from a frame memory 7 and it does not sometimes operate [the scanner section 1 reads and], it chooses the data from a frame memory 7, and sends them to the spatial filter circuit 11 of the next step.
[0025] The spatial filter circuit 11 gives edge enhancement to an alphabetic character to an image, and it is used in order to raise the sharpness of an alphabetic character, or to perform data smoothing to a halftone dot image and to prevent interference with the dither pattern in latter gradation processing. You may make it change edge enhancement/data smoothing accommodative into the image for 1 page using the result of the image area separation circuit which is not illustrated.
[0026] The next color correction circuit 12 is a circuit which carries out masking processing for amending distortion of the spectral characteristic of the color material of YMC used by distortion and the printer of the color-separation property of the scanner section 1. The next UCR/UCA circuit 13 is a circuit which computes the amount which transposes the intersection of CMY to the color material of K. The next gamma correction circuit 14 is an amendment circuit where fluctuation of **** of a printer, aging, etc. is amended and a predetermined gradation property is acquired. The last gradation amendment circuit 15 is a circuit for performing area gradation processing of dithering etc. if needed, and securing predetermined gradation nature.
[0027] The KCMY data after gradation processing are sent out to a printer 16 one by one, and a full color copy image is formed. However, in the case of monochrome mode, only K data are sent out to a

printer 16, and imaging completes it in one color. According to other single color modes, only the data of the required color version are sent out to a printer 16, and imaging is completed only by the corresponding color.

[0028] Next, a compressing expanding circuit 5 is explained. Drawing 2 is the block diagram of a general coding network (compression circuit). As for the RGB data read by the scanner section 1, coding processing is performed in 2x2-pixel block 21 unit. RGB data carry out color conversion by the color conversion circuit 22 per pixel at YUV data with the procedure shown in drawing 3 , in order to raise the quality of a compression image. However, Y is a brightness component and UV is a color difference component.

[0029] Since the correlation of an RGB code between color components is large, by having compressed into each color independence, its coding effectiveness is bad. By carrying out color conversion and compressing into the YUV data of low brightness / color difference system of correlation between components, image data with little degradation can be obtained with the same compressibility. In the following S conversion circuit 23, it is changed into a low-frequency component LL and a high frequency component H (generic name of HL, LH, and HH) by the procedure shown in drawing 4 . abcd of drawing 4 is a delimiter to 2x2 blocks 4 pixels which is a coding unit. ABCD represents the value which the abcd pixel of each three component of YUV receives.

[0030] In the quantization circuit 24, the data after S conversion are vector-quantized and the amount of data is reduced. Here, the high frequency component (Y_H) of Y is used and field separation is performed in the field separation circuit 25, and in order to improve the quality of a compression image more, in fields (edge section), such as the alphabetic character section with many high frequency components, many numbers of bits to a high frequency component are assigned, and it constitutes from fields (non-edge section), such as the photograph section with few high frequency components, so that many bits may be assigned to a low-frequency component.

[0031] Assignment of the bit after quantizing to drawing 5 is shown. The recognition signal of the edge section or the non-edge section is assigned to a head, and it encodes to the 32-bit amount of data in total in both of the fields. Since original data are 8 bit x3 color x4 pixel =96 bit, they are the compressibility of 32/96=1/3. The figure in a parenthesis is the number of bits in drawing 5 . 1 bit of a head is a field signal and it is 0 at the time of 1 and an edge field at the time of a non-edge field.

[0032] Drawing 6 is the block diagram of a general decryption circuit (expanding circuit). The coded data by which reading appearance was carried out from the frame memory 7 is divided for every component in a dividing network 3 according to a field signal, and is decoded by the reverse S conversion circuit 32 with the procedure of the reverse S conversion shown in drawing 4 by the YUV data corresponding to each pixel of 2x2. YUV data are returned to RGB data by the reverse color conversion circuit 33 according to the procedure of reverse color conversion of drawing 3 .

[0033] Drawing 7 is the block diagram showing the 1st example of the coding network of this invention. In this invention, when color mode is monochrome mode, a data compression is not performed. Therefore, in the example of drawing 7 , Y (brightness) data are used as data for monochrome modes at the time of monochrome mode. By using brightness data as data for monochrome (single color) images, in case a color copy is reproduced as a monochrome image, consistency with visual shade sensibility is good, and can obtain monochrome copy of a natural impression.

[0034] In the circuit of drawing 7 , a color mode selection signal chooses as data which memorize Y data after color conversion to a frame memory 7 by the selector 26 (1st data selection means). At the time of the full color mode, the fixed-length coded data compressed into one third of the above-mentioned amounts of data is memorized by the frame memory 7.

[0035] Drawing 8 is drawing showing the situation of bit assignment of the incompressible data at the time of monochrome mode, (A) shows the bit assignment in the case of using Y (brightness) data as monochrome data, and (B) shows the bit assignment in the case of using G (Green) data as monochrome data. In 2x2=4 pixel representation, data are the sum total and all are 8 bit x4=32 bits.

[0036] In drawing 8 (A), the brightness data corresponding to the pixel location abcd are memorized by the frame memory 7 as 8 bit x 4-pixel =32 bit data. Incompressible data double timing with the case

where coding processing is carried out by the delay circuit 27. The need that this performs location amendment to the difference in the amount of delay produced in the time of color mode and monochrome mode at the time of memory data read-out in the latter image-processing section 9 is lost.
[0037] Drawing 9 is the block diagram showing an example of the decryption circuit of this invention. The data by which reading appearance was carried out from the frame memory 7 are concerned with color mode, and also perform decryption processing in parallel that there is nothing. At the time of monochrome mode, since decode data are meaningless as image data, they are thrown away, and the data by which transform processing was carried out to RGB as incompressible data by the selector 34 (2nd data selection means) are chosen.
[0038] As mentioned above, RGB data use incompressible data as common data as it is at the time of monochrome mode. That is, it becomes Ra=Ga=B_a=Y_a, R_b=G_b=B_b=Y_b, R_c=G_c=B_c=Y_c, and R_d=G_d=B_d=Y_d. Moreover, in the incompressible data dividing network 35, delay processing for doubling the timing when carrying out decryption processing is also performed.
[0039] It can respond to the color mode of full color and monochrome both, without completely changing actuation of the memory control circuit 6 together with the delay circuit 27 of a previous coding network, since the amount of data at the time of incompressible for monochrome modes becomes the same by adopting one third of compressibility as coding processing.
[0040] Drawing 10 is the block diagram showing the 2nd example of the coding network of this invention. Here, G data before color conversion are used as data at the time of monochrome mode. Since the sensibility to R and B becomes low as compared with previous brightness data, adjustment with visual shade sensibility gets a little bad, but since it is not influenced of the difference of the pixel data location gap of RGB of three channels, or an MTF property, there is an advantage of being especially hard to produce a blot and dotage of monochrome manuscript. [the edge section]
[0041] It is advantageous when copying many manuscripts which contain an image with much edge section, such as an alphabetic character, especially. You may constitute so that which of brightness data or G data may be used at the time of monochrome mode or a user can choose according to liking. In the circuit of drawing 10 , G data before color conversion are memorized to a frame memory 7 as it is as data at the time of monochrome mode.
[0042] Drawing 8 (B) shows bit assignment of this incompressible data. As well as the case of drawing 7 in order to make timing with coding processing in agreement, since incompressible data are delayed in a delay circuit 27, it memorizes to a frame memory 7. When reading data from a frame memory 7, the circuit of drawing 9 can be used like the case where a luminance signal is used. In this case, of course, G data replace G data also with RB data from the first, and are outputted as RGB data.
[0043] In this invention, 2x2-pixel size was adopted as a pixel unit of compression / expanding processing. In this case, the amount of a memory chip required as a frame memory 7 is calculated. Since the amount of data per unit block is 32 bits, when it goes with the memory chip of the word configuration of 16 bit length, a chip will be used per 32 / 16= 2 pieces. Since the required amount of memory is 560.3M bit, with a 64M bit chip, it is 560.3M/2/64M=4.37, and it is revalued and 5 sets and two pieces = ten memory chips are required for it.
[0044] To use a 128M bit chip, it is 560.3M/2/128M=2.18, and it revalues and 3 sets and two pieces = six memory chips are required. In the case of the block unit of 4x4, when a chip (64M bit and 128M bit) is used, it turns out that 16 pieces and eight memory chips can reduce six pieces and two chips from need ******, respectively. Since the activity unit of a chip becomes large so that the number of bits of a unit block increases, this is for the excessive amount exceeding an initial complement to increase.
[0045] Then, if the amount of data which accesses a frame memory 7 at a time is reduced, an improvement of memory effectiveness can be aimed at. Therefore, how to divide unit data and access a frame memory 7 by time sharing is considered. Since it is 128 bits, if it divides into 128 / 32= 4 times by 32 bits 4x4, a frame memory 7 can be mounted at the same memory effectiveness 2x2.
[0046] By the way, when the block length of the access time to a frame memory 7 is 4x4, a 4-pixel clock and in the case of 2x2, it is a 2-pixel clock. In order to quadrisect and carry out memory access by the case of 4x4, it is necessary to access 32-bit data with 4 / 4= 1-pixel clock. This becomes a twice as many

rate as this as compared with accessing 32-bit data with a 2-pixel clock in the case of 2x2.
[0047] for this reason, even when the number of the memory chip to be used is the same, the chip of the high speed corresponding to access of the rate which it is, i.e., an expensive chip, is the need. Therefore, the **** frame memory 7 for small quantity can consist of adopting compression processing of 2x2-pixel size for a cheap memory chip.
[0048]
[Effect of the Invention] According to invention of claims 1, 2, and 3, the frame memory which can use a general-purpose memory chip efficiently can be constituted. Moreover, monochrome copy image of a good gradation property can be visually obtained by low cost. Moreover, monochrome copy image of sharp image quality can be obtained by low cost.
[0049] According to invention of claim 4 and five publications, incompressible data are efficiently memorizable in memory at the time of monochrome mode. Moreover, a compressing expanding circuit with sufficient image quality can consist of low cost.

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PRIOR ART

[Description of the Prior Art] Generally, in the digital copier, the manuscript image was read for every pixel using CCD series etc., A/D conversion of the analog electrical signal acquired by the output of image sensors was carried out, after performing various processings to the digital signal acquired, the signal was given to the recording device and the copy image has been obtained. In a digital color copying machine, the color is separated into R (red), G (Green), and B (blue), the manuscript which should be copied is read, the color material of Y (yellow), M (Magenta), C (cyanogen), and K (black) is used based on this image data, and a color picture is reproduced.
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[0004] On the other hand, the engine performance of a color copying machine is also improving and 50cpm (part for copy/) extent is put in practical use in one color also in the imaging equipment (printer) of the above-mentioned 1 drum type in 600dpi and a copy speed by the pixel consistency. In order to improve the copy speed and pixel consistency of image formation equipment, the method of securing light exposure is also put in practical use by changing the beam which makes the laser beam of writing plurality and uses it for every line.
[0005] On the other hand, in a manuscript reader (scanner), in order for the quantity of light to run short since pixel size becomes small by the increment in a pixel consistency, and to obtain the image data of the quality of a moderate noise level (S/N ratio), reading speed can seldom be gathered. Therefore, there was a problem that the speed of a scanner was slow compared with a printer, and a copy speed was restricted to the speed of a scanner.
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of data [at least] sufficient from the first.
[0009] For this reason, with the technique shown in JP,9-102878,A, compression / expanding processing is performed at the time of a color copy, and it is made to read by memorizing the data for the black versions in memory to monochrome manuscript, while it has been incompressible.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the color picture processor concerning the gestalt of operation of this invention.
[Drawing 2] It is the block diagram of a general coding network.
[Drawing 3] It is the explanatory view of color conversion.
[Drawing 4] It is the explanatory view of S conversion.
[Drawing 5] Compressibility is the explanatory view of one third of the quantization approaches.
[Drawing 6] It is the block diagram of a general decryption circuit.
[Drawing 7] It is the block diagram showing the 1st example of the coding network of this invention.
[Drawing 8] It is the explanatory view of bit assignment of the incompressible data at the time of monochrome mode.
[Drawing 9] It is the block diagram showing an example of the decryption circuit of this invention.
[Drawing 10] It is the block diagram showing the 2nd example of the coding network of this invention.
[Description of Notations]
1 Scanner Section
2 CCD
3 Shading Compensation Circuit
4 Frame Memory Section
5 Compression / Expanding Section
6 Memory Control Circuit
7 Frame Memory
8 Mode Selection Section
9 Image-Processing Section
10 Synthetic Circuit
11 Spatial Filter Circuit
12 Color Correction Circuit
13 UCR/UCA Circuit
14 Gamma Correction Circuit
15 Gradation Processing Circuit
16 Printer

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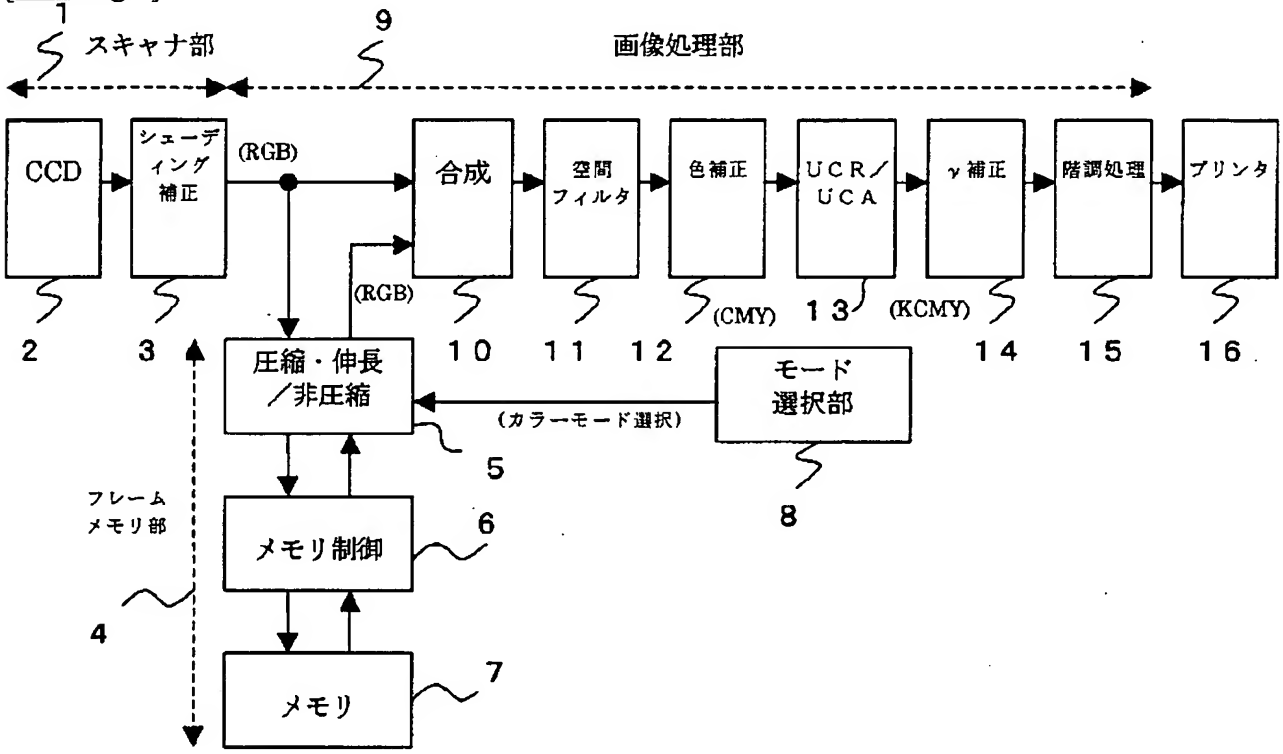
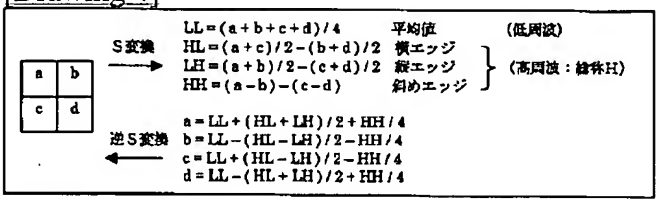
DRAWINGS

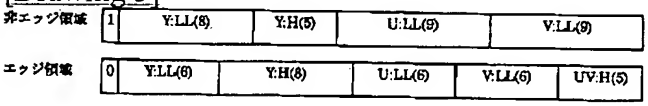
[Drawing 1]



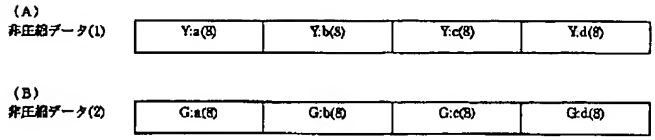
[Drawing 4]



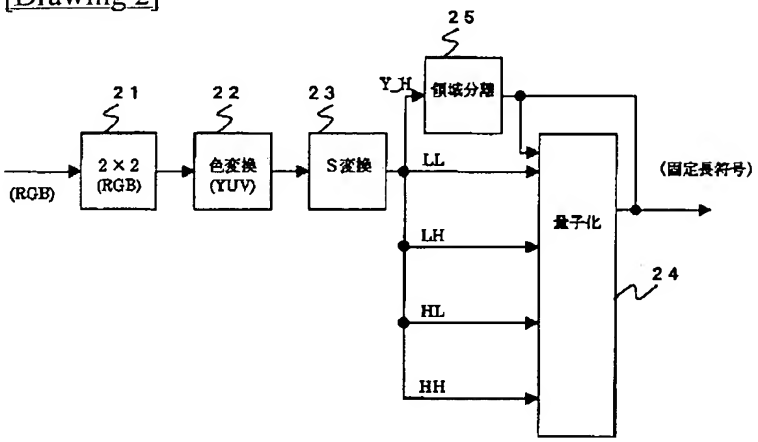
[Drawing 5]



[Drawing 8]



[Drawing 2]



[Drawing 3]

[RGB → YUV] (色変換)

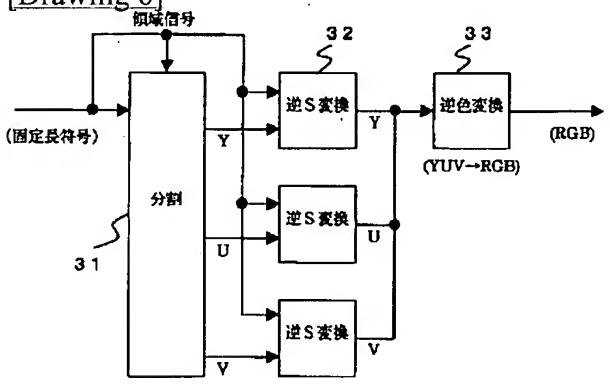
Y=[(R+2G+B)/4]
U=R-G
V=R-B

[YUV → RGB] (逆色変換)

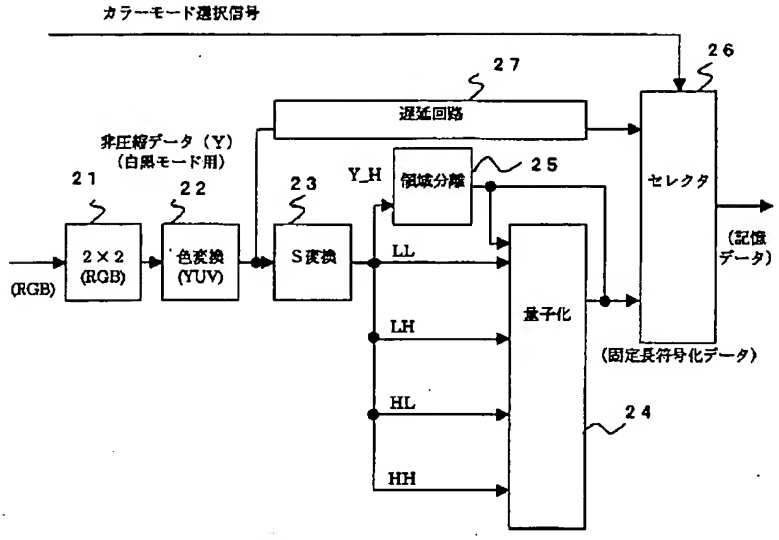
G=Y-[(U+V)/4]
R=U+G
B=V+G

但し、[] は floor 関数 ([] 内の値を超えない最大の整数値を与える関数) である。

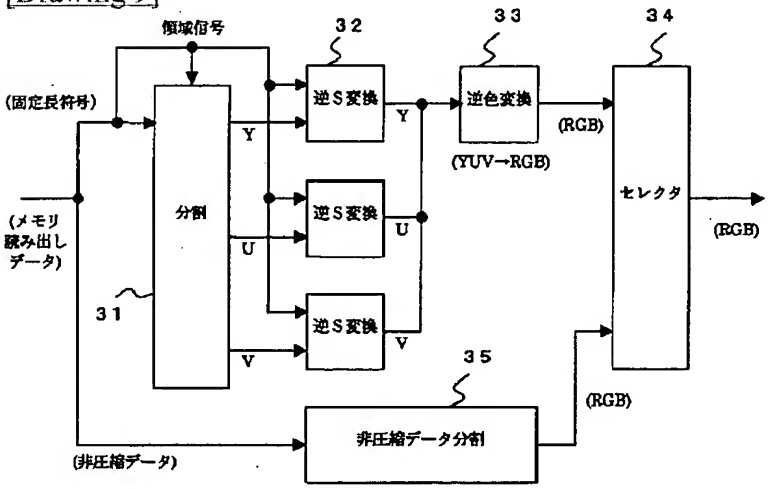
[Drawing 6]



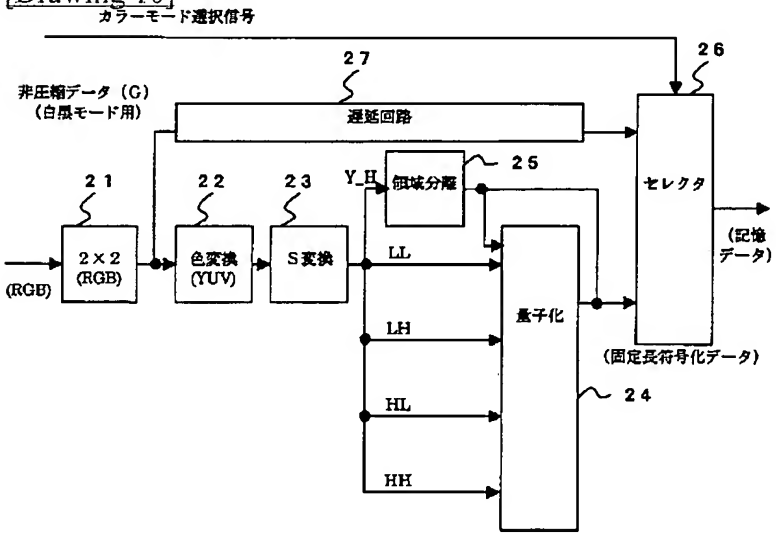
[Drawing 7]



[Drawing 9]



[Drawing 10]



[Translation done.]